

9-1997

Irrational Expectations

Lynn A. Stout
Cornell Law School

Follow this and additional works at: <https://scholarship.law.cornell.edu/facpub>



Part of the [Law and Economics Commons](#)

Recommended Citation

Lynn A. Stout, "Irrational Expectations," 3 Legal Theory 227 (1997)

This Article is brought to you for free and open access by the Faculty Scholarship at Scholarship@Cornell Law: A Digital Repository. It has been accepted for inclusion in Cornell Law Faculty Publications by an authorized administrator of Scholarship@Cornell Law: A Digital Repository. For more information, please contact jmp8@cornell.edu.

IRRATIONAL EXPECTATIONS

Lynn A. Stout

Georgetown University Law Center

Rational expectations models have become a staple of economic theory and the basis for a Nobel Prize. This article argues that rational expectations analysis suffers from potentially fatal flaws that seriously undermine its value in understanding many market phenomena. Using the example of financial markets, the article illustrates how the rational expectations approach has worked to obscure, rather than to illuminate, our understanding of speculation and speculative markets. This misguidance raises problems for law and policy.

I. INTRODUCTION

Economists in recent years have devoted an extraordinary amount of time and attention to the study of financial markets, in particular the markets for corporate securities, and for futures, options, and other “derivative” products. One of the most interesting aspects of these markets is their speculative flavor. A surprising number of the individuals and institutions that trade in securities and derivatives seem to do so in the hope of earning quick profits by predicting short-term price changes.

Laypersons and lawmakers traditionally have looked upon such short-term speculative trading with suspicion. In recent years, however, a consensus has developed among academics that the traditional antispeculative wisdom is misguided, and that speculation, far from working mischief in markets, actually does much economic good. This theoretical perspective has begun to influence contemporary law and policy. Thus, the idea that speculation furthers efficiency has played an important role both in defeating recent administration proposals to impose a minor tax on short-term stock trading, and in insulating the burgeoning market for over-the-counter derivatives from regulatory attack.

Such developments highlight the importance of understanding the conflict between economic theory’s apparent support for the speculator, and the layperson’s traditional condemnation. In this paper I propose that popular wisdom and economic wisdom on speculation have diverged because the prevailing economic theories on speculation—referred to herein as the *risk-hedging* and *information-arbitrage* approaches—do not, in fact, describe the activity popularly known as “speculation.” In many markets, speculative trading may be better described by an alternative model I call the *heterogeneous*

expectations (or HE) approach. The heterogeneous expectations model of speculation posits that differences in traders' beliefs—that is, subjective bullishness and bearishness—can be a catalyst for trading. Although this plausible hypothesis provides theoretical support for the populist intuition that speculation can be socially destructive, modern economic literature curiously neglects the role that subjective disagreement plays in inspiring trading. A notable exception can be found in the work of the economist Jack Hirshleifer, who during the 1970s proposed models of speculation based on expectations heterogeneity. But while Hirshleifer's work on speculation was initially well received, it soon fell into relative obscurity.

I argue that the culprit in this mysterious disappearance appears to have been a body of work in game theory that critiqued Hirshleifer's approach as inconsistent with "rational expectations." Rational expectations analysis, which has become a standard tool of economic analysis, rests on the plausible hypothesis that people making choices anticipate and take into account the likely future actions of others.¹ When applied to the problem of speculation, however, the rational expectations approach produces a peculiar result: It predicts that *bulls and bears should never trade on subjective disagreement*. Although highly implausible, this "no-trade" result appears a principal cause of economic theorists' failure to embrace Hirshleifer's heterogeneous expectations approach.

There is little doubt that rational expectations analysis can offer a variety of useful insights into human and market behavior. I argue, however, that at least as applied to speculative behavior, the rational expectations approach is deeply flawed, both theoretically and empirically. And if the rational expectations approach is unsound, there is much merit in reviving Hirshleifer's heterogeneous expectations model.

The point of this exercise in intellectual history is not to suggest that economic analysis is never useful or appropriate. Rather, I offer a cautionary tale of what can happen when theorists' infatuation with mathematically elegant models intrudes upon the attempt to describe actual market behavior.

II. PREVAILING ECONOMIC THEORIES OF SPECULATION

The phenomenon known as speculation has proven something of an enduring problem for economic theory. Although economists generally use the word "speculation" to refer to the purchase of an asset for resale (rather than for consumption or use as an input in some productive process),

1. For example, Robert Lucas, who was recently awarded a Nobel Prize in economics, used a rational-choice analysis when he argued that high unemployment could not be eliminated through a Keynesian strategy of short-term interest rate cuts because rational employers and investors would anticipate that such measures would be short-lived. *Great Expectations, and Rational Too*, *ECONOMIST* 96 (1995); see generally Deborah A. Redman, *A READER'S GUIDE TO RATIONAL EXPECTATIONS* (1992).

finance literature lacks a generally accepted definition.² Disagreement over the meaning of speculation has been mirrored by disagreement over its normative implications. Where popular opinion has long condemned speculation as a socially wasteful practice that distorts market prices, economic theory applauds speculation as promoting the economic goal of allocative efficiency. Even economists, however, differ in their interpretations of *how* speculation furthers efficiency.³

The ongoing debate over the meaning and consequences of speculation reflects, in part, a curiously schizophrenic quality found in many contemporary theoretical discussions of speculative trading. Academics often refer to "speculation" as if it were a uniform, monolithic activity. Yet the modern finance literature in fact offers at least *two divergent explanations* for why someone might buy an asset in order simply to resell it.

Perhaps the most time-honored theory explains speculation as a consequence of differential risk aversion. (This view is often associated with John Maynard Keynes and John Hicks, among others).⁴ According to this *risk-hedging* model, speculators are traders who extract profits by dealing on favorable terms with more risk-averse "hedgers" willing to pay to avoid the risks of changing prices.

Most modern discussions of speculation make some reference to the risk-hedging model. There is another explanation of speculative trading, however, which also appears frequently in the literature. This second approach, often associated with a classic article by Sanford Grossman and Joseph Stiglitz,⁵ describes speculators as careful researchers who invest in information that allows them to trade on superior terms with less-informed actors trading for consumption or other nonspeculative reasons. This *information-arbitrage* model accordingly explains speculation as a result of differences in traders' willingness to purchase information.⁶

A. Normative Implications of Prevailing Theories

As this brief introduction suggests, the risk-hedging and information-arbitrage approaches differ in many respects. Both models share an important

2. Oliver D. Hart & David M. Kreps, *Price Destabilizing Speculation*, 94 J. POL. ECON. 927, 928 (1986). See Martin S. Fridson, *Exactly What Do You Mean by Speculation?* J. PORTFOLIO MGMT. 29 (Fall 1993).

3. Jeremy C. Stein, *Informational Externalities and Welfare-Reducing Speculation*, 95 J. POL. ECON. 1123 (1987). See Hart & Kreps, *supra* note 2, at 927 (citing large literature on the question); *infra* text accompanying notes 7 and 8 (discussing differing theories of normative consequences of speculation).

4. See John Maynard Keynes, *A TREATISE ON MONEY* (1930); John R. Hicks, *VALUE AND CAPITAL* (1946).

5. See Sanford Grossman & Joseph Stiglitz, *On The Impossibility of Informationally Efficient Markets*, 70 AM. ECON. REV. 393 (1980); see also Albert S. Kyle, *Informed Speculation with Imperfect Competition*, 56 REV. ECON. STUD. 317 (1989).

6. Yet a third approach occasionally found in literature equates speculation with *storage of inventory*. According to this model, speculators are traders who make a living by holding

implication, however: Both imply that *speculative trading promotes the efficient allocation of society's scarce resources*.

Under the risk-hedging model, this implication arises because such transactions generally leave both parties to a trade better off after the trade than they were before it. Risk-averse hedgers are happy to pay speculators to assume the price risk inherent in holding an inventory, while more risk-neutral speculators are happy to be paid a premium to do so. Thus, risk hedging fits neatly into the "invisible hand" model of markets where voluntary exchange is presumed to improve the welfare of both the exchanging parties and society as a whole.

The information-arbitrage model of speculation relies on a somewhat different theory of efficiency benefit. Information arbitrageurs' trades are not, strictly speaking, mutually beneficial: Less-informed traders motivated by consumption or other nonspeculative motives presumably would prefer a market in which they did not have to compete at a systematic disadvantage against arbitrageurs. Arbitrageurs nevertheless perform a salutary social function by identifying mispriced assets and correcting their prices. For example, the information arbitrageur whose meteorological research indicates there will be a drought next year buys wheat, thus driving up prices. Farmers respond to higher wheat prices by planting more wheat, thus reallocating resources to offset the effects of the drought.⁷

themselves out as willing to buy from — or sell to — other traders willing to suffer the bid-ask spread that compensates the speculator for the costs and risks of maintaining inventory. In effect, this *liquidity-dealing* approach likens speculators to used-car dealers who can "buy low and sell high" because other traders value the convenience they offer. See, e.g., Hart & Kreps, *supra* note 2, at 928 (developing model of consumers and speculators where "speculation" is synonymous with storage").

Like the risk-hedging model, the liquidity model implies that speculation provides mutual gains from trade, because consumption traders willingly suffer liquidity dealers' bid-ask spreads in return for being able to buy and sell quickly and conveniently, while dealers enjoy reliable profits from providing liquidity.

7. Though often cited, this argument fails to recognize that improved price accuracy is not enough, alone, to conclude that trading produces a net social benefit. Acquiring and analyzing information is costly. Information arbitrageurs incur research costs not out of altruism, but because they extract wealth from the uninformed traders with whom they deal. Thus, uninformed traders bear the cost of arbitrageurs' *becoming* informed, and there is no guarantee that the social value of more accurate prices exceeds the costs of information arbitrage to uninformed traders. Jack Hirshleifer, *The Private and Social Value of Information and the Reward to Inventive Activity*, 61 AM. ECON. REV. 561 (1971).

As an example of this point, consider the extreme case of information that allows an arbitrageur to forecast with certainty that a particular company's assets will be destroyed within minutes by a meteorite strike. Assume no steps can be taken to prevent, or even alleviate, the loss. The ability to predict the meteorite strike has no *social* value, because acquiring the information does not permit society to allocate resources more efficiently. The prediction nevertheless has substantial *private* value to the arbitrageur who can extract wealth from uninformed traders by shorting the company's stock. Thus, the arbitrageur might spend substantial resources on meteorite prediction, even though such expenditures are wasteful from a social perspective.

The conventional risk-hedging and information-arbitrage models of speculation thus generally support the claim that speculators contribute to allocative efficiency, either by offering their counterparties opportunities for mutually beneficial exchange, or by improving the accuracy of market prices. Increasing allocative efficiency in turn increases net social welfare. Hence, economic theory's general enthusiasm for speculators and for speculation.⁸

B. Do Prevailing Theories Really Describe "Speculation"?

The risk-hedging and information-arbitrage models outlined above offer plausible explanations for why someone might buy an asset for no apparent purpose other than to resell it. Each theory, moreover, likely accounts for some forms of short-term trading in goods and services. Yet various arguments counsel against assuming that either model describes the behavior laypersons think of as "speculation."

First, neither approach seems to comfortably fit the popular image of speculators. The Keynes-Hicks risk-hedging model implies that speculators are insurance salesmen—hardly the first image that comes to mind at the mention of the word "speculator." The information-arbitrage model, on the other hand, can dispense with the element of risk entirely; in theory, truly superior information ought to allow speculators to reap certain profits.⁹ (Hence the "information arbitrage" label preferred here.)¹⁰

Semantic questions aside, the risk-hedging and information-arbitrage models of speculation also carry implications inconsistent with two important empirical realities of certain markets (in particular, stock markets and organized futures and options exchanges) that are closely associated with speculative trading. First, both the risk-hedging and information-arbitrage models imply that speculation is impossible unless the speculator can find a willing, nonspeculating counterparty from whom the speculator can extract trading profits (e.g., a hedger willing to pay to avoid risk, or a consumption buyer unwilling to invest in available but costly information). Yet the stock market seems to consist largely of *speculators trading with other speculators*.¹¹ Second, the risk-hedging and information-arbitrage models

8. See, e.g., Richard A. Posner, *ECONOMIC ANALYSIS OF LAW* 47–48 (4th ed. 1992) (arguing that speculation "performs a valuable economic function" by improving price accuracy and allowing mutually beneficial trades between speculators and hedgers).

9. Although these profits might be statistically *risky*, they should also be *certain*. See *infra* text and note 14 (risk and uncertainty).

10. Similarly, the possibility that speculators are paid for storing goods over time and providing liquidity to buyers and sellers seems better captured by the label "dealing" than "speculating." See *supra* note 6 (liquidity-dealing model).

11. See Lynn A. Stout, *Are Stock Markets Costly Casinos? Disagreement, Market Failure, and Securities Regulation*, 81 VA. L. REV. 611, 661–67 (1995) (discussing evidence that trading in the secondary stock market is dominated by actively managed pension and mutual funds that try to outperform the market by buying and selling securities they perceive to be "mispriced").

also imply that speculators ought on average to profit from their trades. Substantial evidence suggests, however, that in both the stock market and the futures and options exchanges, traders who identify themselves as profit-seeking speculators on average *lose money* by trading.¹²

Yet a third reason to question whether conventional economic thinking adequately grasps the slippery concept of speculation can be found in the vast chasm between economists' ideas concerning the social consequences of speculation, and the traditional beliefs of nonexperts. Modern finance celebrates speculation as a salutary practice that promotes allocative efficiency. But where economic theory praises the speculator, popular wisdom has long condemned him. In the public eye, speculators are market parasites whose trading distorts prices and increases the incidence of poverty.¹³

What can explain this long-standing and curious divide between economists' and noneconomists' views of the merits of speculation? The first instinct of any devoted disciple of economics, of course, is to give the nod to theory, and to dismiss populist hostility toward speculators as the mistaken product of ignorance and envy. I would like to argue the shocking proposition that in this case, however, it is the *theory* that is likely mistaken. The risk-hedging and information-arbitrage models that dominate the economic literature on speculation are both fine models, as far as they go. *But they do not describe the phenomenon laypersons refer to when they speak of "speculation."*

III. THE HETEROGENEOUS EXPECTATIONS THEORY OF SPECULATION

The risk-hedging and information-arbitrage models examined above both explain speculative trades as a consequence of differences among traders: either differences in their levels of *risk aversion* (the risk-hedging model), or differences in their *willingness to invest in information* (the information-arbi-

12. See *id.* at 664 (actively managed pension funds and mutual funds that try to achieve higher returns through short-term trading on average underperform the market); Lester G. Telser, *Why There Are Organized Futures Markets*, 24 J. LAW & ECON. 1, 7, 9 (1981) (reviewing studies finding that traders in futures markets who identify themselves as profit-seeking speculators on average incur losses).

13. This unflattering view is reflected in the fact that hostility toward speculation appears a fundamental characteristic of American law. A variety of common-law and statutory legal doctrines work to raise the costs of speculative transactions, confine them to limited venues, or ban them entirely. Examples include the Commodities Exchange Act; insurance law's rules of indemnity and insurable interest; the common-law doctrine of champerty; the Securities Exchange Act's margin requirements and short sales restrictions; and the Internal Revenue Code's minimum holding period requirement for favorable capital gains treatment of income from the sale of assets. See generally Lynn A. Stout, *Derivatives, Difference Contracts, and the Social Value of Antispeculative Rules* (1997) (manuscript on file with the author).

trage model). There is a third potential difference between traders, however, that may lie closer to lay notions of speculation. That is differences in individual traders' subjective *expectations*.

Economists refer to situations where different individuals hold differing subjective beliefs about the probability of a future event as situations of *statistical uncertainty*.¹⁴ Because introducing uncertainty can enormously compound the difficulty of mathematically modelling behavior, theorists often simply assume it away.¹⁵ In many cases, however, taking account of uncertainty's effects sheds light on otherwise-puzzling and inexplicable market phenomena. The phenomenon of speculation may provide just such a case.¹⁶

Consider the following archetypal example of a speculative transaction inspired by subjective disagreement. Suppose that two risk-averse traders who neither produce nor consume gold, and who have both thoroughly researched the gold market, reach differing subjective conclusions as to whether the market price of gold is likely to rise or fall tomorrow. One trader—the bull—predicts a 100 percent chance that gold will rise from today's price of \$500 per ounce to \$510 per ounce. The other trader—the bear—disagrees and predicts a 100 percent chance gold will fall to \$490. Given their differing expectations, *the bull willingly buys the gold the bear willingly sells*.

This simple example of trading based on subjective disagreement carries a host of lessons. First, it reveals how *agents who share identical consumption preferences, attitudes toward risk, and willingness to invest in information may nevertheless voluntarily trade in assets if they hold heterogeneous expectations for*

14. Although "risk" and "uncertainty" are often used interchangeably, the two words are not synonyms. Finance theorists apply the word "risk" to circumstances where a future outcome is unknown, but the *probability distribution* of possible future outcomes is known. Thus a coin toss is merely risky: Although we do not know whether a tossed coin will come up heads or tails, we know—and can agree—there is a 50 percent chance of either occurring. "Uncertainty" applies to situations where the probability distribution itself is unknown, permitting different individuals to make differing estimates of probabilities. The stock market, for example, is uncertain as well as risky.

15. Thus the standard Capital Asset Pricing Model (CAPM), a staple of modern finance, explicitly assumes that all investors make identical subjective estimates of the likely future risks and returns associated with individual securities. The CAPM accordingly takes account of risk while ignoring uncertainty. Lynn A. Stout, *How Efficient Markets Undervalue Stocks: CAPM and ECMH under Conditions of Disagreement and Uncertainty*, 19:2 CARDOZO L. REV. (1997).

16. The requisite of statistical uncertainty provides a fundamental distinction between the HE approach and the risk-hedging model. This is because trading inspired by differential risk aversion requires risk, but not uncertainty: As long as agents' tastes for risk differ, hedging deals would be negotiated even between agents who shared identical expectations for the probable distribution of risky future prices.

The relationship between uncertainty and the information-arbitrage model is more complex. In a sense, arbitrageurs armed with superior information hold differing subjective estimates of asset values than their less-informed counterparties who are trading for consumption or similar nonspeculative reasons. At the same time, the counterparties do not really disagree with arbitrageurs' estimates, so much as they deliberately choose to remain relatively less-informed and avoid the costs of research.

uncertain future prices. Such disagreement-based trading far more closely resembles the popular image of speculation than trading inspired by differences in risk aversion or information investment. For example, the heterogeneous expectations (HE) model of trading does not require the risk-hedging model's awkward assumption that speculators be less risk-averse than other individuals: Even risk-fearing individuals may speculate if their subjective expectations differ.

The HE model also explains the otherwise-puzzling phenomena of speculator-with-speculator trading. Although such trading seems inconsistent with the risk-hedging and information-arbitrage models—both of which assume that speculators need nonspeculating counterparties to trade—the example offered above supports the notion of “purely” speculative deals between traders who each hope to reap short-term trading profits by dealing with the other. Similarly, the HE approach offers a theoretical explanation for markets where speculators appear, on average, to suffer trading losses.¹⁷ This counterintuitive result can be traced to a peculiar and important element of the HE model referred to herein as *ex post speculator error*.

Let us return to the archetypal case of the bull who expects to reap a \$10 per ounce profit from buying gold, and the bear who expects to avoid a \$10 per ounce loss by selling. Although bull and bear each *expect* ex ante wealth gains of \$10 per ounce from their trade, their ex post returns necessarily *average* \$0.¹⁸ Whether gold prices rise, fall, or remain at \$500, speculation on disagreement in a common-value asset¹⁹ is a zero-sum game in which one player's gain necessarily is balanced by another player's loss.²⁰

17. Speculator losses are inconsistent with the risk-hedging and information-arbitrage models, which each predict that speculators on average ought to profit from their trades. Of course, price volatility (risk) implies that speculators occasionally lose money on a transaction. Over time, however, a speculator willing to accept risk or to invest in truly superior information should reap certain profits. In contrast, the HE model also incorporates the common intuition that speculation involves a high probability of loss for speculators. After all, when two people trade on disagreeing predictions, at least one must be disappointed.

18. The ex post error characteristic of HE trading can be described as a consequence of imperfect information that permits uncertainty (subjective disagreement). Given perfect information regarding the future, bull and bear both would *know* whether gold were going to rise or fall. No trade would occur because if one were willing to buy the other would be unwilling to sell, and vice versa. Imperfect information permits uncertainty, however, and uncertainty permits bull and bear to hold differing expectations that lead them to perceive opportunities to extract trading profits from each other despite the zero-sum nature of such transactions.

19. The phrase “common-value asset” refers to any asset that agents who share homogeneous expectations would value equally. Thus, a payment of money, or a highly liquid financial instrument reflecting the right to a stream of payments, usually is regarded as a common value asset on the theory that people attach identical values to money. Noncommon value assets are assets for which agents have unique tastes, such as mango ice cream or opera tickets. Agents who share identical expectations for the future may nevertheless display varying willingness to pay for noncommon value assets.

20. This result is in contrast to hedging trades that redistribute risk, which can be mutually beneficial to both speculator and nonspeculator ex post as well as seeming mutually beneficial

When speculators must incur expenses to trade, speculation devolves from a zero-sum game to a negative-sum game in which the average player *loses* money. Suppose, for example, that bull and bear each must pay \$2 per ounce commissions to trade gold. In such a case, although the traders expect an average ex ante gain of \$8 each (\$16 total), they necessarily experience an ex post average loss of -\$2 each (-\$4 total). Although one party may ultimately turn a profit on the deal, the loser's loss inevitably will be more than the winner's gain. For example, if gold rises to \$510, the bull will enjoy an \$8 per ounce net gain—outweighed by the bear's \$12 net loss.

A. Normative Implications of the Heterogeneous Expectations Theory

The element of ex post error examined above provides a theoretical explanation of why speculators who seek trading profits in the stock market or on the futures and options exchanges end up, on average, losing money. Perhaps more importantly, however, the HE model's prediction of ex post speculator error may also go far in explaining why noneconomists have traditionally been hostile toward speculators. In contrast to the risk-hedging and information-arbitrage models (which predict that speculation serves efficiency, either by furthering mutually beneficial risk hedging or by improving the accuracy of asset prices), the HE approach implies that *speculation can reduce net trader welfare without any compensating benefit from improved price accuracy*. In other words, speculation can be inefficient.

Heterogeneous expectations trading's capacity to harm speculators is implicit in the element of ex post error examined above. Most obviously, HE trading harms speculators because it has the perverse effect of decreasing their ex post wealth (assuming positive transactions costs). Disagreement-based trading can also, however, harm speculators by increasing the *risk* they bear.²¹ A speculator heavily invested in gold, for example, can reduce his investment portfolio's exposure to gold market risk by selling bullion and buying other investments, such as stocks or real estate.²² If the speculator expects gold prices to rise in the near future,

ex ante. Information arbitrage perhaps should not be described as mutually beneficial, because rational consumption traders would prefer a market without information arbitrageurs to a market with them. Information arbitrage does not, however, involve ex post error: The consumption traders who trade at a systematic disadvantage relative to information arbitrageurs decline to invest in information because the costs, to them, outweigh the benefits.

21. See Lynn A. Stout, *Betting the Bank: How Derivatives Trading Can Increase Risks and Erode Returns in Financial Markets*, 21 J. CORP. L. 53, 62 (1995).

22. Because the prices of nongold assets are likely to vary in different patterns from gold prices (e.g., stock prices rise when gold prices fall), diversifying can reduce the overall risk or variation in an asset portfolio. See generally Richard A. Brealey & Stewart C. Myers, *Principles of Corporate Finance* 129–74 (4th ed. 1991) (discussing risk-reducing benefits of diversification).

however, he may buy *more* gold, thus reducing his diversification and *increasing* his risk. Thus, HE speculators' (on average) mistakenly perceived opportunity to profit from their predictions for future prices may tempt them into accepting risks they would otherwise avoid, just as it tempts them into incurring transaction costs.²³

From a social perspective, any harm that speculation might inflict on speculators might be worth bearing if HE trading provided a compensating external benefit in the form of more accurate asset prices. Unlike arbitrage on truly superior information, however, speculation based on differences of opinion cannot be assumed to produce such an agreeable result. When two disagreeing speculators trade on the basis of their differing opinions, at least one must ultimately be proven mistaken. HE trading by speculators who are as likely to be wrong as right in their belief they have identified a "mispriced" good or service consequently is as likely to move prices *away* from correct levels, as *toward* them.²⁴

B. Why Has the Modern Literature Overlooked the Heterogeneous Expectations Approach?

The heterogeneous expectations theory of trading accords well with speculation's popular image; it explains a variety of otherwise puzzling empirical phenomena found in speculative markets; and, perhaps most importantly, it provides a firm theoretical foundation for the intuition that speculation can be a nonproductive and potentially self-destructive activity. Why, then, does conventional economic wisdom overlook the heterogeneous expecta-

23. In effect, speculators' ex post mistaken belief they will earn trading profits creates the illusion of a "risk premium" that compensates them for increasing their risk exposure.

24. Readers who are interested in more formal expositions of this intuition can consult a large and growing finance literature on heterogeneous expectations asset pricing models. See, e.g., William F. Sharpe, *PORTFOLIO THEORY AND CAPITAL MARKETS* 104-13 (1970) (chapter entitled "Disagreement"); John Lintner, *The Aggregation of Investor's Diverse Judgments and Preferences in Purely Competitive Securities Markets*, 4 J. FIN. & QUANT. ANALYSIS 347 (1969); Edward R. Miller, *Risk, Uncertainty, and Divergence of Opinion*, 32 J. FIN. 1151 (1977); Joseph T. Williams, *Capital Asset Prices with Heterogeneous Beliefs*, 5 J. FIN. ECON. 219 (1977); Robert Jarrow, *Heterogeneous Expectations, Restrictions on Short Sales, and Equilibrium Asset Prices*, 35 J. FIN. 1105 (1980); Joram Mayshar, *On Divergence of Opinion and Imperfections in Capital Markets*, 73 AM. ECON. REV. 114 (1983); Hal R. Varian, *Divergence of Opinion in Complete Markets: A Note*, 40 J. FIN. 309 (1985); Lynn A. Stout, *Are Takeover Premiums Really Premiums? Market Price, Fair Value, and Corporate Law*, 99 YALE L. J. 1235 (1990); Richard A. Booth, *Discounts and Other Mysteries of Corporate Finance*, 79 CAL. L. REV. 1053; Mordecai Kurz, *Asset Prices with Rational Beliefs* (Monograph, Center for Economic Policy Research, Stanford University) (February 1994); Stout, *supra* note 15. One of the more interesting implications of this literature is that, when markets are in some form incomplete or imperfect, the introduction of speculators can in some cases destabilize prices, leading to a speculative "bubble." See, e.g., Stout, *supra* note 13 (discussing bubbles); Jack Treynor, "Bulls, Bears and Market Bubbles" (unpublished manuscript on file with author).

tions model, instead emphasizing risk hedging and information arbitrage as explanations for speculative trading.²⁵

To the layperson, the notion that subjective disagreement over the future can inspire speculation may seem obvious. At least one prominent economist has also suggested that a trading model based on disagreeing expectations may offer a more accurate account of speculative behavior than do prevailing models. In 1975 and 1977, Jack Hirshleifer published two articles presenting a model of speculation driven by what he termed "differential beliefs."²⁶ Although Hirshleifer did not explore the normative implications of his disagreement-based approach, his articles clearly set out an attractive alternative to prevailing theories.²⁷ In the two decades following its publication, however, Hirshleifer's work on speculation has received relatively little attention from finance economists, and is virtually never cited by legal scholars who study speculative markets.²⁸ The implications of Hirshleifer's approach remain largely unrecognized and undeveloped.

It seems plausible that this peculiar neglect can be traced, in part, to a variety of aspects of the HE approach that are likely to seem unappealing to disciples of neoclassical economic theory. The HE model refuses to overlook the messy concept of statistical uncertainty; it heretically suggests that voluntary exchange is not necessarily mutually beneficial, implying that paternalistic interference in the choices of consenting adults can produce welfare gains; it invites observers to judge welfare effects by predictable ex post net results, rather than individual subjective ex ante expectations; and perhaps most unpalatably (at least to conservative scholars of the "Chicago school"), it hints that such capitalist icons as the New York Stock Exchange and the Chicago Board of Trade may not, necessarily, be efficient.

Modern theorists' curious reluctance to incorporate expectations heterogeneity and ex post error into their discussions of speculation also, however,

25. See Stein, *supra* note 3, at 1125 (noting that papers on speculation tend "to ignore the issue of heterogeneous information among market participants"); see, e.g., Hart & Kreps, *supra* note 2 at 928–29 (focusing on storage function and assuming speculators have access to the same information and draw identical inferences); John Leach, *Rational Speculation*, 99 J. POL. ECON. 131, 132 (1991) (modeling speculation where all agents place an identical value on an asset).

Of course, the information-arbitrage model implies heterogeneity in the sense that informed arbitrageurs' expectations differ from uninformed consumption traders' expectations. This heterogeneity, however, is due to differential information costs rather than statistical uncertainty. See *supra* text and notes 14–16, 18 (discussing requisite of uncertainty in heterogeneous expectations analysis).

26. Jack Hirshleifer, *Speculation and Equilibrium*, 89 Q. J. ECON. 519 (1975); Jack Hirshleifer, *The Theory of Speculation Under Alternative Regimes of Markets*, 32 J. FIN. 975 (1977). Hirshleifer attributes a similar approach to Holbrook Working.

27. I have argued at length elsewhere that a heterogeneous expectations approach may solve a number of mysteries that have long plagued scholars studying financial markets and speculative behavior. See, e.g., Stout, *supra* note 11; Stout, *supra* note 13; Stout, *supra* note 15; and Stout, *supra* note 11.

28. A recent search of the LEXIS "lawrev" database did not uncover a single citation to either of Hirshleifer's articles on speculation.

appears to spring from a more thoughtful source. A few years after Hirshleifer published his work on speculation, a number of prominent game theorists published papers that criticized the notion of disagreement-based trading as theoretically flawed. Indeed, these papers went further: they argued that individuals who share rational expectations would *never* trade on disagreement.²⁹ It is perhaps not too much of an exaggeration to suggest that in the wake of this result, the notion that speculation might reflect trading on subjective disagreement seemed to sink from the finance literature without a trace.³⁰

IV. THE RATIONAL EXPECTATIONS CRITIQUE OF THE HETEROGENEOUS EXPECTATIONS MODEL

To noneconomists, the idea that disagreeing predictions drive speculation may seem so logical as to be obvious. By the same token, game theorists' claim that people with rational expectations should *never* trade on disagreement seems a bit absurd. The "no-trade" theorems rest, however, on the plausible intuition that *people extract information from others' willingness to trade with them*.³¹ In other words, rational individuals who estimate uncertain probabilities from limited information recognize that their estimates are imperfect and are willing to revise them in the face of another's disagreement.

Consider the following simple example of how revising expectations in light of another's disagreement can halt trading. Suppose John and Mary are given an urn containing four marbles, two white and two black. They each draw a marble from the urn and inspect it without showing it to the other. John draws a white marble, and Mary draws a black. John and Mary now each have private information that leads them to revise their estimates of the probable color of the third marble drawn from the urn. John's private information suggests a two-thirds chance that the third marble will

29. See, e.g., Robert J. Aumann, *Agreeing to Disagree*, 4 ANNALS STAT. 1236 (1976); John D. Geanakoplos & Heraklis M. Polmarchkis, *We Can't Disagree Forever*, 28 J. ECON. THEORY 192 (1982); Paul Milgrom & Nancy Stokey, *Information, Trade, and Common Knowledge*, 26 J. ECON. THEORY 17 (1982); Jean Tirole, *On the Possibility of Speculation under Rational Expectations*, 50 ECONOMETRICA 1163 (1982).

30. Interestingly, the idea that mistaken disagreement with market price may inspire some trading has recently reappeared in form of "noise theory," which postulates that some subset of traders in the market suffer from cognitive defects that make them value securities irrationally. Curiously, noise theorists generally cite neither Hirshleifer nor his critics. See, e.g., J. Bradford De Long et al., *The Size and Incidence of the Losses from Noise Trading*, 44 J. FIN. 681 (1989); J. Bradford De Long, et al., *Noise Trader Risk in Financial Markets*, 98 J. POL. ECON. 703 (1990); Andrei Shleifer & Lawrence H. Summers, *The Noise Trader Approach to Finance*, J. ECON. PERSP. (Spring 1990), 19; John Y. Campbell & Albert S. Kyle, *Smart Money, Noise Trading, and Stock Price Behaviour*, 60 REV. ECON. STUD. 1 (1993).

31. The underlying idea has sometimes been termed the "Groucho Marx Theorem" in honor of Groucho's observation that he would never want to belong to any club that would have him as a member.

be black (he knows he has already removed one of the whites). Mary estimates a two-thirds chance the third draw will be white (she knows she has removed one of the black marbles).

Will John's and Mary's disagreeing estimates lead them to bet (that is, trade) against each other? John should know that if Mary offers to bet on white, that is because she has drawn a black marble. Similarly, Mary should infer from John's willingness to bet on black that he has drawn a white marble. Each should realize that there is one white and one black marble remaining in the urn. *Because they now both estimate a 50–50 probability that the third draw will be white or black, John and Mary will not trade.*³²

As this example illustrates, the rational expectations no-trade result rests on the notion that a bull should hesitate to buy once he learns the bear is willing to sell, and vice versa. In effect, each trader asks of him- or herself: "What does my counterparty know that I don't?" It seems likely that this sort of process does occur to some extent in markets, and that the recognition that other traders in the market may have better information discourages many would-be speculators.

Yet even the most casual empiricism suggests that the extreme result of the no-trade theorem does not hold true. Gamblers still bet at racetracks; investment fund managers still trade derivatives believing they can predict interest rates; stockbrokers still dine daily on the commissions paid by investors hoping to "beat the market." Reality does not conform to rational expectations theory's predictions, at least in the extreme form of the no-trade theorems. That observation in turn suggests a need to reexamine theory.

V. THEORETICAL WEAKNESSES OF RATIONAL EXPECTATIONS

Closer inspection of the rational expectations prediction that people should not speculate on disagreement reveals two important considerations that should lead any careful observer to discount its value in understanding speculative markets. The first consideration is theoretical. In reaching its counterintuitive result, the no-trade theorem relies on several strong—and unlikely—assumptions. Among these are the assumptions of *concordant beliefs* (or *uniform prior beliefs*) and *common knowledge*.

The term "concordant beliefs" means that all rational agents process information in an identical fashion and would reach the same conclusion given the same data. (As will be discussed below, the concordant beliefs assumption in turn assumes that people share uniform prior beliefs about probabilities, beliefs they only revise in light of new data). An event is said

32. Unless, of course, they have a taste for risk.

to be "common knowledge" if all agents know it, all agents know that all agents know it, and so on in infinite regress.

Taken together, concordant beliefs and common knowledge produce the rational expectations result that bulls and bears refuse to trade. Although a bull might initially believe gold is likely to rise in price, if it is common knowledge that all agents share concordant beliefs, the bull also will believe that the bear processes information just as he does, and so would not be willing to sell unless the bear had access to private negative information that would lead the bull, also, to conclude gold was overpriced. The bull consequently revises his initial optimistic estimate of gold downwards to reflect the bear's pessimism, while the bear similarly revises her initial pessimistic estimate upwards in the light of the bull's optimism. The final result is that bull and bear come to agree in their estimates, and no trade occurs.

This result is both elegant and provocative. *It is also, however, quite fragile.* If the assumptions of concordant beliefs and common knowledge are violated, the no-trade result does not survive. And while concordant beliefs and common knowledge are useful conventions to game theorists trying to model behavior under conditions of uncertainty, *they seem highly unlikely to apply in most markets.*

A. The Unlikelihood of Concordant Beliefs (Uniform Priors)

The assumption of concordant beliefs—that rational agents process similar information similarly—seems, at first, plausible. It necessarily relies, however, on the Bayesian convention that assumes that agents trying to predict future events all start with identical prior probability estimates which they then revise in light of sample information. Recall the example of John and Mary drawing marbles from an urn. In that example, John and Mary were both told that the urn contained two black and two white marbles. They thus shared an *initial common prior* belief about the probability of drawing white or black.

The scenario changes dramatically if we assume that, before their initial draw, John and Mary held *differing* prior beliefs about the proportions of white and black marbles in the urn. Suppose that John initially believes there are three white marbles and one black marble in the urn. Mary, however, believes there are three black and one white. If John draws a black marble, he now will estimate a 100 percent probability that the third marble drawn will be white. If Mary draws a white, she will estimate a 100 percent probability that the third marble will be black. Might John's and Mary's disagreeing estimates lead them to bet against each other on the third draw?

The answer now is yes. Given John's prior beliefs, he could now interpret Mary's willingness to bet on black as a sign that she drew a white marble in the first round, and thus thinks there is still some possibility of drawing a

black marble from the urn. (John, having drawn a black marble, thinks he knows better). Mary in turn can perceive John's willingness to bet on white as a signal that he drew a black marble in the first draw, and does not know (as she thinks she does) that no white marbles remain in the urn. Thus, both John and Mary may revise their estimates to account for the possibility that their counterparty has private information. *Even after doing so, however, they may each want to trade, because of the possibility that their disagreement springs from the other's (supposedly mistaken) differing prior.*

The net result is that, when agents' priors differ, the assumption of concordant beliefs does not hold: Rational agents may draw differing conclusions from similar data. And it seems likely that peoples' priors *do* differ. The Bayesian assumption that people share identical priors, while mathematically convenient, lacks either a theoretical or an empirical foundation. Indeed, it makes sense only if *knowledge and belief are innate* (and identically so).³³ If knowledge is a product of experience, different individuals' priors will be determined by their differing initial experiences—in effect, their first draws from the urn. Hence, it seems more plausible to assume that individuals have differing, randomly generated priors, than it is to assume they start out with uniform priors.

That observation in turn suggests that insight might be gained from a rational expectations model that examines trading behavior when people have *randomly generated* prior beliefs. Yet this approach raises its own problems. Under Bayesian conventions, the theorist (or speculator) who attempts to model trading among individuals assuming randomly generated priors must still make some assumptions both about the *distribution* of those subjective priors, and about their *mean* or average. In other words, we must start with some priors about priors. This sort of theoretical bootstrapping, unfortunately, serves mathematical convenience while sacrificing predictive accuracy. As a result, rational expectations models that presume concordant beliefs and either uniform priors, or some assumed distribution of randomly generated priors, cannot be relied upon to predict behavior in a world where individuals' prior beliefs differ in ways that are undeterminable a priori.

B. The Unlikelihood of Common Knowledge

The discussion above suggests that, when beliefs are not "concordant," disagreement-based trading may be consistent with rational expectations. A similar result obtains if people share concordant beliefs, but this fact is not "common knowledge."

Game theorists describe information as common knowledge if all poten-

33. It can be argued, however, that different individuals' priors may tend to converge over time as they gain experience by repeatedly drawing from the same urn (the world) and revise their estimates. This approach suggests the value of a "learning" model of trading behavior. See *infra* Part VI.A. (learning model).

tial traders know it, all potential traders know all potential traders know it, all know that all know that all know it, and so on.³⁴ Common knowledge of concordant beliefs is essential to the no-trade result because, otherwise, Mary might interpret John's willingness to bet against her as a signal that John has mistaken priors or is irrational, rather than a signal that John has private information that should lead Mary to revise her estimates as well. In other words, trading on disagreement becomes rational when traders believe *others* in the market may be mistaken or irrational.

Moreover, it is not enough simply to assume that traders have common knowledge that they share concordant beliefs (uniform priors). To reach the no-trade result, traders must also have common knowledge that their *posterior* beliefs *differ*—that is, that private information has caused them to revise their estimates away from the uniform prior. Thus, bullish John will only hesitate to buy from Mary if he believes her motive for selling is bearishness. If he thinks Mary is selling for some other reason—perhaps she simply needs the money—John will not revise his own beliefs simply because Mary is willing to trade.

In the real world, of course, traders lack common knowledge either of other traders' prior, or their posterior, beliefs. Given the realities of such common and cognition-impairing conditions as alcoholism, Alzheimer's disease, and bipolar disease (just to name a few), it seems unreasonable for a trader to presume that all other traders are rational and incapable of error. Moreover, in estimating others' posterior beliefs it is impossible for traders to discern their counterparties' motives with certainty. Even in such highly speculative arenas as the stock markets or futures and options exchanges, a significant portion of traders are in the market for reasons other than disagreement with market prices—e.g., because of changing risk or consumption preferences, to raise funds, or for tax or other strategic reasons.

The assumption of common knowledge both of traders' uniform priors, and of their differing posteriors, thus is highly unrealistic. That observation carries important implications for the wisdom of assuming the no-trade result applies to actual markets. In real markets, common knowledge does not exist. And when common knowledge does not exist, the no-trade result does not survive.

C. Conclusion: Theoretical Implausibility of the No-Trade Result

In the wake of the publication of the no-trade theorems, a consensus seems to have developed in the finance culture that trading on differing subjective estimates of probabilities must be "irrational."³⁵ Close examination of the

34. Milgrom & Stokey, *supra* note 29, at 18.

35. See, e.g., Tirole, *supra* note 29 at 1164 (trading on subjective disagreement irrational); Paul G. Mahoney, *Is There a Cure for "Excessive" Trading?*, 81 VA. L. REV. 713, 722–24 (same); see also *supra* note 30 ("noise" theorists who presume some speculators are irrational).

rational expectations no-trade result suggests, however, that the label “rational expectations” is something of a misnomer. Disagreement-based trading may indeed be inconsistent with rational expectations, so defined. *It may not, however, be inconsistent with rationality.*

Given certain realistic assumptions, even traders who are rational in a very strict sense may trade on disagreeing predictions. This is because the no-trade result necessarily relies upon a number of strong — and empirically implausible—underlying assumptions. If these assumptions are violated, rational agents certainly may still extract information from the price-taking behavior of others in the market, and revise their initial expectations to some degree. But in a world where traders start from different priors, lack common knowledge of uniform priors, or lack common knowledge of differing posteriors, their revisions are likely to be only partial. Some degree of trading on disagreement will persist. *In other words, the no-trade result is not robust.*³⁶

Indeed, any other suggestion would seem flatly contradicted by the data. Overwhelming evidence indicates that apparently normal people often invest substantial resources on the basis of disagreement. (The ongoing academic debate over the meaning and consequences of speculation is, of course, itself a case in point.) If trading on disagreement is inconsistent with rational expectations, this form of “irrationality” appears both endemic and predictable.

That observation in turn sets the stage for examining a second important consideration that cuts against relying on the no-trade theorem as a grounds for rejecting the notion that people trade on disagreement. At the level of theory, it is not clear whether (absent concordant beliefs and common knowledge) rational traders would decline to trade on the basis of their differing subjective expectations for future price changes. The issue may be purely academic, however. Perhaps rational traders should not trade. A growing body of empirical evidence suggests, however, that *people are not rational.*

VI. EMPIRICAL WEAKNESSES OF THE RATIONAL EXPECTATIONS MODEL

The discussion above suggests that, in a static model, individuals who lack concordant beliefs and common knowledge may rationally choose to trade with each other on the basis of their disagreeing predictions for an uncertain future. What happens, however, in a dynamic system where individuals

36. See Jack Hirshleifer, *Two Models of Speculation and Information*, in *TIME, UNCERTAINTY, AND INFORMATION* 292–99 (Jack Hirshleifer ed., 1989); Lynn A. Stout, *Agreeing to Disagree over Excessive Trading*, 81 VA. L. REV. 751 (1995).

gather information and trade not once, but on several successive occasions? In other words, should trading on heterogeneous expectations persist over time?

A. Learned Rational Expectations

Perhaps not. It can be argued that, where people gather information and trade repeatedly, conditions that approximate concordant beliefs and common knowledge may develop over time, and the apparently implausible assumptions underlying the no-trade result become more plausible. Consider, for example, the assumption that would-be speculators deciding whether to trade on private information begin with uniform prior beliefs about the probabilities of events in the world. If knowledge is based on experience, the notion that people share uniform priors makes little sense. There is considerable variation in the world, and different people's initial experiences (that is, their first draws from the urn) are likely to vary considerably. Over time, however, as rational individuals collect more information and gain more experience in the world (make more draws from the same urn), their subjective estimates of the probabilities of events may become more similar. In other words, even if traders start out with different priors, as they gain experience their beliefs may *become* more concordant.

A similar process can create conditions approximating the game theorists' assumption of common knowledge. In a static model, individuals who lack common knowledge of other traders' uniform priors and differing posteriors may trade on private information in the belief either that their counterparties' priors are mistaken, or that their counterparty is trading for reasons that have nothing to do with private information. Over time, however, speculators who trade repeatedly may gain experience (especially if they lose money) that leads them to accord greater respect for the possibility that others' priors are more accurate than their own, and also to get a better sense of the likelihood that their counterparty's trade is also motivated by private information (rather than changing consumption preferences or risk aversion). The result is that, even if people do not start out with "rational expectations," over time their behavior may evolve until it *approximates* rational expectations.

There is evidence, in fact, that people *do* learn to revise their subjective estimates of value in light of others' disagreement. However, they seem to learn slowly and incompletely. A market composed only of brilliant and perfectly rational traders might indeed come quickly to approximate the rational expectations result, so that trading on disagreement swiftly comes to a halt. Unfortunately, it appears that most of us are not that smart.

B. The Winner's Curse

The question of whether and how quickly people learn to revise their subjective expectations in light of others' disagreement has been studied most closely in the context of the "winner's curse" that affects auctions in which an asset is sold to the highest bidder. Extensive evidence indicates that in auctions of common-value assets (that is, assets which all the auction participants would value equally given the same information),³⁷ the winning bidder tends to pay too much. In other words, the actual value of the auctioned asset turns out to be less than the auction price. Thus the winner is "cursed."³⁸

This peculiar phenomenon can be explained as follows. When auction participants are bidding for a common-value asset—say, oil companies are bidding for the right to drill for oil on a particular parcel of land—their estimates of value will be based in part on private information, such as the reports prepared by each company's geologists. Different geologists will make differing estimates. If errors are unbiased, the best estimate of the value of the parcel will be an average of all the geologists' estimates. The average estimate will not win the auction, however. Rather, it is the *most optimistic* bid that "wins."

Auction bidders with rational expectations should realize that, if they win the auction, this is evidence that all the other participants' private information indicates that their bid is too high. They also should realize they can avoid the winner's curse if they discount their bid somewhat to take account of the possibility that they might win.³⁹ The net result is that all bidders should discount their bids. While the average bid may now fall *below* the best estimate of the auctioned asset's value, the winner avoids the curse.

C. Empirical Evidence on the Winner's Curse and Learned Rational Expectations

Do auction bidders in fact follow the rational expectations pattern and avoid the winner's curse? The answer seems to be "not entirely." Extensive evidence from both experimental and field studies suggests that, at least initially, individuals invited to participate in an auction of a common-value asset fail to revise their bids enough to avoid the curse. For example, in one experiment, graduate students were asked to bid on jars of coins. Each of the jars contained coins with a total value of \$8. The average bid was \$5.13, suggesting either that the students were extremely risk-averse, or that (in accord with rational expectations theory) they were revising their bids

37. See *supra* note 19 (common-value assets).

38. See generally Richard H. Thaler, THE WINNER'S CURSE: PARADOXES AND ANOMALIES OF ECONOMIC LIFE 50–62 (1992).

39. *Id.* at 51, 61, & n.10 (winner's curse inconsistent with rational expectations).

downward to account for the possibility that their fellow students might disagree with their estimates, and they might win the auction. But their revisions were at best partial; the average winning bid was \$10.01, resulting in a \$2.01 loss to the auction winner.⁴⁰

Of course, instances of this nature—that is, cases where people fall prey to the winner's curse when they first participate in an auction—may not necessarily be inconsistent with rationality, because the conditions of concordant beliefs and common knowledge may not apply. However, when rational agents participate in auctions repeatedly, conditions that closely resemble concordant beliefs and common knowledge may develop over time. In other words, people should learn enough about their own and others' prior and posterior estimates from trading that they eventually come to discount their bids fully and accurately.

Do auction bidders actually follow this "learned rational expectations" pattern and avoid the winner's curse? Again, the answer seems to be no. Some people can, and do, learn. Unfortunately, *most learn slowly, and some people appear not to learn at all.*

In one typical study, 69 M.B.A. students at Northwestern University were presented with a winner's-curse-like problem with financial rewards. The problem was repeated 20 times, with feedback after each trial. Of the 69 students, only 5 learned to avoid the curse (on average, after 8 trials). There was no evidence of learning among the other 64. Indeed, in the last few trials, the other 64 students did *less* well in avoiding the curse than they had in previous trials.⁴¹

Only an economist is likely to be shocked by such results. Consider the difficulty of the problem faced by auction bidders who attempt a Bayesian revision of their own subjective estimates to take account of others' disagreement. Bidders must draw conclusions about their own and other bidders' priors; the rationality of the competing bidders; and the nature and extent of the other bidders' subjective disagreement. Such calculations are difficult enough in the sterile atmosphere of an M.B.A. classroom where the auction bidders are few in number, relatively homogeneous, and bidding on a common-value asset for which no bidder is likely to have a unique taste or preference. Imagine how much more difficult the problem becomes in markets of thousands of diverse participants, many of whom may be trading for any number of reasons unrelated to their disagreement with market price. Perhaps a Cray supercomputer, if given enough information, could make such a calculation quickly and accurately. For the average *Homo sapiens*, however, the sheer difficulty of such a feat seems likely to discourage even the attempt. Instead, the average "irrational" trader falls back on rules of thumb, conventional wisdom, and the lessons of bitter experience.

In sum, the notion that rational individuals should never trade on dis-

40. *Id.* at 52.

41. Thaler, *supra* note 40, at 54–55.

agreeing subjective predictions for an uncertain future rests on heroic assumptions about people's cognitive abilities, assumptions that are both fundamentally and obviously incorrect. If people had rational expectations, a chess match would consist of two opponents facing each other briefly before one concedes. In the real world, even grand masters may play for hours with the final outcome in doubt. If chess grand masters cannot conform to the rational expectations model, it seems highly unlikely that the rest of us can, either.

VII. CONCLUSION

Scholars frequently intone the mantra that economic theory can be a "useful tool" for analyzing problems of law and policy. Even the best tool can be misused, however. In their quest to describe and, increasingly, mathematically model human behavior, economists often grossly simplify a complex reality. Usually such simplification does no harm. In other cases, however, the result can be a caricature that does more to hinder than to promote our understanding of markets.

This paper explores one such instance. Contemporary theoretical discussions of speculation tend to focus exclusively on the risk-hedging and information-arbitrage models of speculative trading. Although these models certainly explain some forms of trading, a third alternative—the heterogeneous expectations model—seems in many ways to mirror far more closely the common understanding of what is meant by "speculation." Nevertheless, the heterogeneous expectations approach has met with a cool reception among theorists, primarily because it appears inconsistent with rational expectations analysis.

The rational expectations approach clearly offers a variety of useful insights into human and market behavior. When applied to speculative trading, however, the rational expectations model appears both theoretically and empirically flawed. However elegant the no-trade theorems might be, at the practical level their utility in understanding speculative markets seems quite limited. Unfortunately, modern commentators writing on financial markets seem to have seized upon the rational expectations approach with a greater sense of its benefits than of its limitations. The result has been a persistent and widespread misunderstanding of the nature and consequences of speculation.

That observation in turn suggests that much might be gained from incorporating the reality of disagreement into our analysis of speculative markets. Recent interest in noise-trading theory,⁴² and in heterogeneous expectations-based asset pricing models,⁴³ suggests that finance theorists

42. See sources cited *supra* note 30.

43. See sources cited *supra* note 24.

finally may be starting to look in this direction. Unfortunately, we may have lost many years in our quest to understand financial markets by running down the dead end of rational expectations.

What can explain this (with the benefit of hindsight) obvious mistake? Perhaps economists themselves lack rational expectations, and so work long and hard to create models that presume that other people understand instantly what took the economist years to figure out. But another reason may be that economics has evolved away from being a dismal “science” — that is, an inquiry into the nature of the world—and toward becoming a branch of mathematics where models are treasured for their elegance, charm, and tractability, rather than their ability to predict behavior. That is fine for economists. Legal scholars and policymakers should think twice, however, before presuming that economic models mirror real markets.